

[0035] What is claimed is:

- 1 1. A high bandwidth semiconductor photodiode responsive to incident  
2 electromagnetic radiation comprising:  
3 an absorption narrow bandgap layer;  
4 a wide bandgap layer disposed substantially adjacent to the absorption  
5 layer;  
6 a first doped layer having a first conductivity type disposed substantially  
7 adjacent to the wide bandgap layer; and  
8 a passivation region disposed substantially adjacent to the wide bandgap  
9 layer and the first doped layer.
- 1 2. The semiconductor photodiode of claim 1 further comprising a second  
2 doped layer disposed substantially adjacent to the absorption narrow  
3 bandgap layer.
- 1 3. The semiconductor photodiode of claim 2 further comprising a third  
2 doped layer disposed substantially adjacent to the first doped layer and  
3 adapted to form an ohmic contact with a substantially adjacent  
4 metalization layer.
- 1 4. The semiconductor photodiode of claim 1 further comprising:  
2 a second doped layer; and  
3 an impact layer disposed substantially adjacent to the second doped layer  
4 and the absorption narrow bandgap layer,

5 wherein the ratio of the ionization coefficient for electrons relative to the  
6 ionization coefficient for holes for the impact layer is larger than the  
7 corresponding ratio for the absorption narrow bandgap layer, the wide  
8 bandgap layer, the first doped layer, and the second doped layer.

1 5. The semiconductor photodiode of claim 1 wherein the first doped layer  
2 comprises indium phosphide

1 6. The semiconductor photodiode of claim 1 wherein the absorption layer  
2 comprises indium gallium arsenide.

1 7. The semiconductor photodiode of claim 1 wherein the wide bandgap  
2 layer varies in thickness from an etching thickness  $t_1$  to a deposition  
3 thickness  $t_2$ .

1 8. A method for fabricating a shallow mesa semiconductor photodiode,  
2 comprising the steps of:

3 generating an absorption narrow bandgap layer;

4 generating a wide bandgap layer disposed substantially adjacent to the  
5 absorption narrow bandgap layer;

6 generating a first doped layer disposed substantially adjacent to the wide  
7 bandgap layer, the first doped layer having a first conductivity type;

8 etching a region of the first doped layer;

9 etching a region of the intrinsic wide bandgap layer; and

10 generating a passivation region disposed substantially adjacent to the first  
11 doped layer and the intrinsic wide bandgap layer.

- 1 9. The method of claim 8 further comprising generating a second doped  
2 layer disposed substantially adjacent to the absorption narrow bandgap  
3 layer.
- 1 10. The method of claim 9 further comprising generating a third doped layer  
2 disposed substantially adjacent to the first doped layer and capable of  
3 forming an ohmic contact with a substantially adjacent metalization layer.
- 1 11. The method of claim 8 further comprising:  
2 generating a second doped layer; and  
3 generating an impact layer disposed substantially adjacent to the second  
4 doped layer and the absorption narrow bandgap layer,  
5 wherein the ratio of the ionization coefficient for electrons relative to the  
6 ionization coefficient for holes for the impact layer is larger than the  
7 corresponding ratio for the absorption narrow bandgap layer, the wide  
8 bandgap layer, the first doped layer, and the second doped layer.
- 1 12. The method of claim 11 further comprising generating a third doped  
2 layer disposed substantially adjacent to the first doped layer and capable  
3 of forming an ohmic contact with a substantially adjacent metalization  
4 layer.
- 1 13. The method of claim 8 wherein the first doped layer comprises indium  
2 phosphide.
- 1 14. The method of claim 8 wherein the absorption layer comprises indium  
2 gallium arsenide.
- 1 15. The method of claim 8 wherein the wide bandgap layer varies in  
2 thickness from an etching thickness  $t_1$  to a deposition thickness  $t_2$ .